(Tentative Proposal)

Pilot Protein Production and Feeding Program

for a Selected Region in Korea

Prepared by
The Meals for Millions Foundation
March 1967

Pilot Protein Production and Feeding Program for a Selected Region in Korea

TABLE OF CONTENTS

BACKGROUND

The Meals for Millions Foundation began shipments of Multi-Purpose Food to Korea soon after World War II for emergency feeding. To date approximately two million pounds have been shipped and distributed through voluntary agencies to orphanages, hospitals, schools and needy areas. These shipments were sent free of freight charges through many individual organizations. Currently there are three sources of funds for freight; they are the Catholic Relief Service for Catholic agencies, Church World Services for major Protestant groups and Christian Reformed World Relief Committee for Evangelical groups.

Initial testimonies from governmental and private sources in Korea have indicated the benefits shown in the use of Multi-Purpose Food in infant feeding and pre-school children, a school lunch program, hospital feeding, relief work, and other instances. An extensive study was made for the increasing of food production and the feeding of children in South Korea. A copy of this study is attached. An initial visit to Korea was made in 1964 by Miss Florence Rose, then the Executive Director of Meals for Millions. Conferences were held with Mr. Yu, Tuk Han, President of the Yu Hu Industrial Co., Ltd. and Mr. Ha, Sun Kan, the Director of the Bureau of Cultural and Physical Education, Ministry of Education, as well as Dr. W. K. Koh, President of Seoul Women's College and Dr. Yang, Hyun Soon, Chairman, Home Economics Department, Seoul Women's College. At the time of this visit Dr. Yang was the only Ph. D. in nutrition in the entire country.

Studies have shown that there is a great need for added protein throughout Korea. Meat and meat products are expensive and in 1964 the surprisingly low number of 5000 cows is an argument for the development of a high protein food which is especially suitable to babies and young children.

In late December 1966 a visit was made to Korea by Dwight D. Clark, Director of the Volunteers in Asia, Inc. Mr. Clark made several inquiries concerning the interest in the establishment of a multi-purpose food plant in South Korea. Due to the availability of resources needed to include transportation and crops, recommendation for location of the first plant was Pusan. This city was chosen because of the size of the population, the large industrial complex and the number of orphanages and similar institutions. The second choice was the city of Taegu for many of the same reasons that were held for Pusan. The Honorable Pak, Kyong Won, Governor of Kangwan Do is also very interested in the establishment of a multi-purpose food plant in his province.

In any event a good public relations advertising and educational program by medical and public health officials would be a necessity.

Pilot Protein Production and Feeding Program for a Selected Region in Korea

Introduction

The following is a proposed program of action to establish in an area of Korea, production and distribution of low-cost, high protein foods to alleviate conditions of malnutrition, especially among young children. The distribution of the high protein foods to this vulnerable segment of the population would be directed at both pre-school and school-age children. Because of the institutionalized accessibility of the latter and the more difficult 'home' accessibility of the former, two different distribution methods are required. While the intended project might conceivably be limited to school children in its early phases for purposes of introduction and determination of acceptability, the extension of the feeding to pre-school children is recommended as soon as possible. The extreme vulnerability of this age group (usually 1 - 6 years) to possibilities of permanent physical and mental retardation which might result from protein and vitamin deficiencies, makes inclusion of a pre-school program basic to any effective effort to raise nutritional levels.

It must be recognized that improving nutritional values as well as increasing quantitative deficiencies of food is basic to any country's social and economic development. Without the deliberate, planned qualitative application of technology to the nutritional needs of the people, it is unlikely that the large numbers of persons in lower economic levels will ever break the cycle of undernutrition - low productivity - low purchasing power and undernutrition. *

The proposal to develop production and marketing of indigenous low-cost protein foods in Korea can be divided into five phases: the feasibility study, acceptability trials, pre-commercial phase, commercial phase and extension to other areas. On the assumption that feasibility would be established in the first phase and that acceptance and motivation for such a project would be achieved in a selected region of Korea, such as Pusan, Taegu, Seoul, Chun Chon, detailed consideration would then be given for the subsequent operational phases. In the proposal, which is intended to initiate the feasibility study, the subsequent phases can only be presented sketchily for the purpose of indicating the extent of the whole endeavor.

An appropriate form for the acceptability trials would be determined from the findings of the feasibility study. The following discussions are to be regarded as indicative of the approach which might be used. The acceptability trials would be carried out on a test population of about 500 school children. In that phase the subjects would be selected, divided into two groups, about 400 getting the powdered soy beverage and tested against a smaller control group of about 100 consuming powdered cow's milk. For the purpose of acceptability trials an imported, flavorless, full-fat soy beverage would be used. Various flavorings and sweeteners would be added locally to determine taste preferences. The acceptability trials would be carried out over a period of about 180 days

*See "An End to Undernutrition: Industry's Reward to Itself." Donald E. Reese, President, Proteinas, S. A. de C. V., Mexico, February 1965.

Tests would be made under medical supervision to determine tolerance to various levels of consumption and to look for any possible adverse reactions. Previous tests on the soy beverage indicate such possibilities as remote, but with malnourished children difficulties from other causes might be associated erroneously with the testing unless professional diagnosis is available. Selection of the appropriate food form is the purpose of the acceptability trials. The results will determine the approach to be followed in the pre-commercial phase.

Although the basis of this entire proposal is the stimulation of private initiative in Korea to increase food production on a self-sustaining basis, it must be recognized that no private businessman would risk his capital in such a program unless he were convinced that a reasonable market existed. For this reason a pre-commercial or subsidized phase has been planned to develop and test the market, and determine reasonable cost-price-profit ratios. During such phase an experimental feeding program would include consumption of the beverage and/or other high protein products. A massive education or propaganda program would be carried out over a period of one to two years to encourage consumption of the fortified products.

The pre-commercial phase has as one of its basic objectives the training of a local manpower source competent in the various technical skills and professional, managerial and marketing skills. This will be accomplished through an intensive training period of about 6 months at the Meals for Millions Foundation's experimental plant, laboratory and training facility in the United States, followed by supervised on-the-job training in Korea.

The commercial phase would provide for the assimilation of the program by a private company, phasing-in of trained Korean supervisors, and phasing-out of all subsidized efforts and direct outside control. The pre-commercial plant and equipment would be withdrawn and ready for re-use in an extension of the program to other regions in Korea. The plans for the commercial phase would be worked out in the preceding phases outlined below.

1. FEASIBILITY STUDY. This is a preliminary phase intended to determine the feasibility of the above project in an area of Korea.

1.1 Objectives of the Study

To examine in situ the feasibility of setting up a small industry (or industries) for the manufacture of low-cost, high protein food supplement of the "multi-purpose food" type (MPF) using indigenous ingredients.

To look into the possibility of organizing local interests into a small company for the above purpose.

To find what national financing sources (development banks, etc.) may be available for granting long-term loans to small industries such as the above.

To obtain information about laws and regulations governing the establishment of small industries in Korea.

To form an estimate of the management capabilities of local personnel and the kind and type of training that might be necessary.

To investigate local sources of raw materials, particularly oilseeds such as soybeans and cottonseed, as well as fish meal.

To determine the extent to which such products are now grown in the region and their availability.

To consider, if not grown now or if produced in insufficient quantities, how to initiate or how to increase production.

To determine, from climatic, soil and other agriculturally relevant factors, what varieties of soy or other oilseeds would flourish best in the region.

To investigate the availability, sources, prices and trade practices in purchasing the vitamin and mineral additions which are to be blended with a multi-purpose protein concentrate.

To ascertain whether oilseed grits or meal is available and to what extent from Korean producers of edible oils.

To examine the viability of the present and potential market for vegetable (and possibly fish) protein fortified foods and the appropriate channels of distribution.

To enlist the interest and help of the local medical and technical professions as well as leading religious and civic authorities.

To engage in discussions with local school authorities with the view of examining the possibility and the best procedures for setting up a school feeding program which would add enough protein to the children's diets to give reasonable assurance of reaching safe minimums of protein intake. Such a program can also be extended to introduce the parents to the fortified foods.

1.2 Plan of Action. The plan of action for the first phase will consist of the following steps:

Preparation prior to the field trip to Korea. Correspondence will be initiated with government, school, religious and agricultural people to establish connections, to arrange for discussions and to obtain preliminary information. This phase will begin shortly after the proposal is approved.

A field trip would be made in early 1967, for a duration of three to four weeks. Members of the team would have experience working on similar projects in Northeast Brazil, Mexico, Iran and Ecuador, etc. They would handle the matters indicated under the objectives referring to technology, economics, industrial and agricultural organization for production, and will endeavor to enlist the interest and professional support of the medical people and health authorities and to prepare the way for a school and other institutional feeding programs.

The results of the field work are to be presented in a formal report together with suggestions and recommendations for implementing the second part.

A preliminary design of the proposed plant would be prepared and suggestions for appropriate agricultural projects which might promote the production of raw materials for indigenous high protein, vitamin and mineral fortified foods. A plan for carrying out an informative program for the local medical profession and health authorities would be formulated and a preliminary plan for using the supplement in a school feeding program and/or other institutional feeding programs.

1.3 Costs (Phase I). A budget of $12,000 will be needed to perform the above activities. This would defray the costs and expenses of the preparatory work, the field trip, of preparing reports and recommendations, and of securing the services of draftsmen, technicians and consultants to the extent needed. 50% each of the cost would be financed by the Meals for Millions Foundation and a Korean source.

PHASE II

2. ACCEPTABILITY TRIALS: (Subject to revision based on findings of the feasibility study).

2.1 Purpose. The acceptability trials are required to determine taste preferences and tolerance of the product or products to be used in large-scale feeding and in developing a commercial market.

2.2 Experimental Design. As cow's milk is being used where available, a controlled study will be made on the comparative acceptability of a soy-based beverage with cow's milk. The powdered soy beverage will be diluted to various protein levels and concentrations of solids and compared with reconstituted powdered cow's milk.

2.2.1 Selection of Subjects. Approximately 500 subjects will be chosen at different institutions, appropriately stratified into age groups and representative levels of income. Of these, 400 will be fed a supplementary soy beverage as the experimental group. The other 100 will be fed reconstituted powdered cow's milk.

2.2.2 Selection of Test Food. The food to be tested will probably be a full-fat soy beverage which will be brought in for testing in various formulations to develop a prototype for local production. Acceptability to this, modified in various forms with flavoring and varying levels of sweetness, will be tested.

2.2.3 Tests to be Made. Children in the study will be given physical examinations with height and weight data and hemoglobin levels being recorded at the beginning and end of the study. Changes in hemoglobin levels will be measurable and comparisons of these are likely to be meaningful over a period of 6 months.

2.2.4 Measures of Acceptability. Several levels of dilution of the soy beverage powder will be tested and reactions noted for the first few weeks to observe acceptability at three levels or more: eg. 1 part powder to 10 parts water by weight, one part solids to six parts water and one part powder to eight parts water.

2.2.5 Cost Comparisons at Various Levels of Acceptability. The cost ratios of these formulations will also be established and compared with those of milk.

2.3 Administration of the Study.

2.3.1 Supervision. A medical advisor experienced in public health and nutrition work will set up the program of physical examinations, recording of data and carry out whatever other measures are required to set up the tests. He will remain with the project for several weeks. Cost for round trip travel from the U.S. and living expenses would be about $2,000.

2.3.2 Professional Korean Counterpart. A Korean physician would be engaged part-time for a period of about 6 months. He would work during the first month with the medical advisor (above) and would be engaged for an additional five months during the testing. Estimated costs would be $1,000.

2.3.3 Korean Auxiliary Personnel. The acceptability trials would be carried out under the above professional guidance with assistance of two non-professional helpers for 6 months at $2.00 per day, or a total of $750.

2.4 Amount of Food for Acceptability Studies.

2.4.1 Cost of Imported Soy Beverage. To feed 500 children would require about $15 per day for 180 days or $2,700.

2.4.2 Cost of Purchasing Local Powdered Milk for Comparison. To feed local purchased milk to the 100 children who serve as controls @ $0.10 for 1/3 liter will cost $10 per day, or $1,800 for 180 days.

2.5 Total Costs of Acceptability Trials.

2.5.1 Direct Costs.

Soy Beverage		$2,700
Powdered Milk		1,800
Study Personnel		
U.S. physician	$2,000	
Korean physician (6 mo. x 1/2 time)	1,000	
Korean helpers @ $2.00/day x 6 mo.)	750	$3,750
		$8,250

2.5.2 Indirect Costs. Costs of overhead, report, incidental equipment for study, etc., are estimated at $3,000.

2.6 Suggestions for Sources of Financing for Acceptability Study. The following organizations have made grants to various recipients to finance acceptability trials and are suggested as possible sources of support for this section of the proposal: National Institute of Health (OIR Division); AID (TCR Division); UNICEF; Williams-Waterman Fund.

PHASE III

3. PRE-COMMERCIAL PHASE. (Preliminary plan subject to later revision and changes based on findings of the feasibility study.)

3.1 Introduction. The pre-commercial phase is the installation and operation of a low investment facility for the production of high protein food such as a beverage, fortified with vitamins and minerals, with a system for distributing high protein food which is amenable to expansion to a commercial scale. The presentation describes these components and a plan of action with several courses which could be followed alternatively. Each suggested course reflects a particular range of objectives and indicates a cost for their achievement. The costs must be regarded as preliminary estimates which will be checked and revised as the information becomes available in the preceding feasibility study.

As preliminary interest in using a high protein beverage from vegetable sources such as "soy milk" has been indicated to us, the proposed development of the pre-commercial phase is based on the assumed feasibility of a soy beverage. The above study will investigate this and other possible source materials such as safflower, cottonseed, etc.

3.2 Food Processing Plant. The pre-commercial food processing plant is proposed to produce about 1000 gallons (3785 liters) of soy milk per day, or 454 kilograms of dry (powdered) solids daily, which can be reconstituted to the above 3785 liters of soy milk by adding water.

3.2.1 Fixed Capital Costs. The cost of such a plant is estimated to be about $35,000 of which $30,000 is for equipment delivered to the plant site and $5,000 is for buildings and land. In addition to the fixed capital, working capital is required to operate the plant and to distribute the product, thus generating income from sales.

3.2.2 Income from Sales. The value of the annual income which may be generated from the sales of the daily production of 3785 liters of soy milk, or equivalent powder, is estimated to be (at $0.39 per kg. of solids) $64,545. An additional income derives from hulls and fiber filtered from the milk which is useful as a component of chicken feed or other animal feed. This is estimated as 158.9 kilograms daily and (at $0.11 per kg., dry weight basis) yields 6,369 annually, which provides a total of about $70,914 annually.

3.2.3 Cost of Soybeans. ** To obtain the above income, 6760 bushels of soybeans (165.5 metric tons) per year are required. At current U.S. prices this would cost $16,359.20. (Average price paid to U.S. farmers in the last five years was $2.42 per bushel.) Soybeans are plentiful in Korea.

3.2.4 Cost of Vitamin and Mineral Additives. In addition, vitamins and essential minerals amounting to $25 per ton of dry solids is required, calculating at current U.S. prices. This fortifies the resulting milk so that 1-1/4 cups will supply approximately 1/3 of the daily protein and vitamin requirements of a 7 to 9 year old child. *** This also suffices for a non-pregnant, non-lactating woman, and if increased to 1-1/2 cups suffices for a man. The vitamin and mineral additives cost out to be about $4,137.50 annually.

**Although it may be possible to obtain soybeans under PL 480 programs, or from direct donations of the commodity, a cost factor is given for purposes of analysis.

***Food and Nutrition Board, National Research Council (1948) indicates 60 grams of protein daily for children 7 to 9 years old.

3.2.5 Direct Costs of Labor. About 5 men, full-time, can operate the plant (7 might be employed in order to allow off-time on weekends.) Distribution of milk to the neighborhood can be accomplished by 10 men. Calculating labor at $2.00 per day, the annual cost is estimated at $10,950.

3.2.6 Working Capital. Working capital must provide the means for insuring a capability of meeting current obligations and financing essential inventories. Inasmuch as the soybeans will be harvested during one season of the year, they must be accumulated at that time and placed into storage. At peak, about 10 month's supply must be stored. About half of the peak quantity could be financed by short term credit, the other half must be provided through working capital. This implies about $7,317 for soybean inventory. Because overseas transportation is slow and sometimes irregular, at least 1 month's supply of vitamin and mineral additives should be ordered at any one time with a 3 months' buffer stock as a minimum supply. The vitamin and mineral procurement adds approximately $2,439 to the working capital requirements. As sugar and flavoring are available locally, about $1,000 should cover an average on-hand supply. Some cash must be on hand to meet current labor and operating costs. About 1/4 of the annual payroll comes to $2,740 and adding about $2,000 for miscellaneous operating expenses, the total for working capital comes to $14,500. Monthly sales will be at the rate of approximately $5,900. About 1/2 of this can be used to offset some of the working capital requirements, reducing the latter to a total of about $11,500.

3.2.7 Sweeteners. The beverage contemplated would be based on local preferences for color, sweetness and other flavoring. Sugar is believed to be about $0.10 per pound in Korea, or $0.22 per kg. For each kg. of soy base, we estimate using .35 kg. of sweetener at a cost of $0.077. With a powdered beverage production of 454 kg. per day, or 165,710 kg. per year, the annual cost to sweeten the product appropriately would be about $12,743.

3.2.8 Start-Up Costs. In addition to the investments and expenditures for material items, costs will be incurred in planning, initiating, implementing the program, and training personnel.

3.2.9 Cost of Technical Assistance. The cost of providing technical help in the field to start-up operations, to do field training, to establish the pre-commercial marketing activities, and to overcome initial production difficulties is estimated to be $9,000.*

3.2.10 Training of Nationals. The two young men who are designated as "Administration and Supervision" (Section under Operating Statement, Page 8), should have potential for managerial and technical work and should be sent for a training course at Meals for Millions' Santa Monica training facility. Counting transportation, food, lodging and small personal expenses, and the training fee, the cost is estimated to be $7,500. These men will be prepared not only for the pre-commercial phase, but for the later commercial operation as well. The total start-up cost comes to $16,500.

*Personnel who have done this type of work in Chile and Brazil will undertake the field work in Korea.

3.2.11 Summary of Financial Requirements. The pre-commercial phase (Phase III) requires financing as summarized below.

Pre-Commercial Food Processing Plant

Equipment	$ 30,000
Land and Building	5,000
Working Capital	11,500
Start-Up Costs (Training & Technical Assistance)	16,500
Total	$ 63,000

Pre-Commercial Experimental Farm

Land (10 hectares @ $200/hectare)	$ 2,000
Sheds, equipment, working capital	1,500
	$ 3,500

Total Investment, Phase III - - - - - - - - - - - - $66,500

3.2.12 Projected Operating Statement. With the foregoing estimates in hand, a tentative projection can be made of the profit or loss expectations from operation of the proposed pre-commercial plant. These are summarized below in conventional form on an annual basis.

Table 1. Projected Annual Operating Statement.

Sales		
Equivalent dry soy milk powder (454 kg. daily @ $0.39/kg)		$64,545
Fiber and hull pulp (158.9 kg. daily @ $0.11/kg)		6,369
Total gross sales		$70,914
Cost of Sales		
Raw materials		
Soybeans (165.5 MT @ $98.84)	$16,359	
Vitamins and minerals	4,137	
Sweeteners	12,743	
Cost of raw materials		$33,239
Direct Labor		
*Factory and distribution (15 men @ $2.00/day)		$10,950
Total cost of Sales		$44,189
Administration and Other Costs		
*Supervision & administration (2 men)	$ 7,000	
Power and fuel	1,500	
Interest on total inv. ($66,500 @ 10%)	6,650	
Depreciation of Fix. Cap. ($35,000 in 10 yrs.)	3,500	
Other administration costs	1,000	
Total cost of administration, etc.		$19,650
**Gross profit before taxes		$ 7,075

3.2.13 Return on Investment. The return on investment is estimated from the above as $7,075 plus $6,650 (10% interest on investment shown as administrative cost) on the total investment of $66,500, or 21.1%.

*No allowance has been made for payroll taxes, fringe benefits or accident insurance.

**Accurate data is unknown until feasibility study is made. Therefore the above must be regarded as tentative and provisional.

3.3 Comparison of "Soy Milk" With Animal Milk. The proposed soy milk product may be compared with animal milk on the basis of nutrients and cost. This admittedly omits many other aspects of comparison.

3.3.1 Comparison of Nutrient Characteristics. There is an almost universal practice in smaller towns in underdeveloped areas where health regulations relative to milk are lacking or not enforced, of diluting whole milk with about 20% or more of water before reaching the consumer. For this reason the comparisons will be made with the diluted milk as well as with whole milk on a "per liter" basis. The Table of Nutrient Characteristics following indicates that the soy milk of the proposed concentration furnishes almost twice the protein of whole cow's milk, more than twice the thiamine and niacin, but is lower in calcium (See Table on Page 10.)

3.3.2 Cost of Soy Milk Compared with Cow's Milk. The operating statement was based on a price of $0.05 per liter of soy milk for South Korea. This compares with U.S. prices in semi-rural communities of $0.18 to $0.20 per quart or $0.19 to $0.21 per liter. In Northeast Brazil the price in small interior towns with local dairy herds is about $0.15 per liter for the diluted milk delivered by independent vendors. This would come to $0.19 per liter for whole milk. In Bombay, India, the current price of water buffalo milk is approximately $0.28 per liter. It appears reasonable to compare the proposed price of $0.05 per liter of soy milk with the general price of $0.15 to $0.20 per liter of whole milk. Therefore the soy milk should be able to compete readily with locally produced cow's milk assuming that such were available.

3.4 Market Potentials. In starting any new enterprise, once the technical aspects have been settled, the question of markets is of crucial importance. For the proposed project two separate markets are available. One is the market which depends on normal commercial channels. The other is the requirement for feeding children covered by the pre-school and school feeding program.

3.4.1 Normal Commercial Market. If the site of the proposed plant is not too far from a medium size town, a substantial market may be served. With an urban population of 80,000, about 16,000 families will be resident. Assume 30% will be in upper working class, middle, and upper class. With a consumption of one liter per family, a potential market for approximately 4,800 liters exists. Assuming that half the available market can be reached, a reasonable estimate for the immediately realizable market is 2,400 liters daily.

3.4.2 Institutional and Pre-School Market. To provide one-third of a liter per child daily for the whole child population requires 8,000 liters or approximately 2,000 kg. per day. * An estimated 30% or 24,000 children of the 80,000 population would be of school or pre-school age.

3.4.3 Total Market Realizable in the Short Term. Combining the local commercial market for fluid milk with the institutional market, a daily production equivalent to approximately two metric tons of dry powder or the equivalent in a combination of dry and fluid milk, would appear to be reasonable. The proposed production during the pre-commercial phase of only 454 kg. daily is well within this "reasonable limit."

*When in the commercial phase, it is expected to break even at a daily powdered beverage production between 2 to 3 tons (2,000-3,000 kg.). The plant would produce 9,000 kg. daily at full production. To consume such production would require a per child cost of about $0.033 per day, $1.80 per month, or $10.00 per child per year.

Nutrient Characteristics

	Proposed Soy Milk	Whole Cow's Milk - USDA* Hdbk.	Soy Milk USDA* Hdbk.	Diluted + Cow's Milk	RDA + Children 7 to 9 yrs.	Amt. Suppl. by 1/3 liter Pro. Soy Milk
Water %	86.4	87	92.5	89		
Protein gr/li	63.5	36	35	30	60	21
Fat gr/li	28	40	15	33		
Carbohydrates** gr/li	151	50	21	42		
Total Solids gr/li	254	134	77	112		
Calories per li	1076	700	340	580	2000	207
VITAMINS						
Vitamin A IU/li	3200	1650	1/145	1380	3500	1100
Thiamine mg/li	2.2	0.41	0.92	0.33	1.0	0.7
Riboflavin mg/li	1.9	1.75	0.41	1.46	1.5	0.6
Niacin mg/li	6.0	1.03	3.1	0.86	10	2.0
Vitamin B_6 mg/li	0.13	0.72	--	0.60		0.04
Vitamin B_{12} mg/li	.0021	--	--	--		.0007
Ascorbic Acid mg/li	120	10.3	0	8.6	60	40
Vitamin D IU/li	415	2/450	--	--	400	140
MINERALS						
Calcium mg/li	750	1210	216	1000	1000	250
Phosphorus mg/li	880	960	480	800	1000	290
Iron mg/li	13.2	1.03	7.2	0.86	10	4.5
Iodine mg/li	0.58	0.21	--	0.18	0.30	0.19

1/ Estimated from the content of whole soybeans.
2/ Fortified with Vitamin D.
* Composition of Foods U. S. D. A. Agricultural Handbook No. 8.
\+ Whole cow's milk diluted with 20% water (common in underdeveloped areas).
\+ Recommended Daily Allowances. Food and Nutrition Board, National Research Council, 1948.
** The amount of sugar will be adjusted to suit local taste and optimize acceptability.

3.5 Procurement of Soybeans. Soybeans are available as a commercial crop in Korea. 162,000 metric tons were produced in 1964; this amount is typical of the years 1961 to 1964.* The requirement of the demonstration plant is approximately 454 kg. daily or 165.5 metric tons annually. Inasmuch as this requirement is about 0.1% of the annual crop, local procurement should not be difficult. The estimate is based on the following statistics.

Soybean Production in Korea**

	Production 1000 M.T.	Area Planted 1000 Hectares	Yield Kg/Ha.
Average 1955-9	149	271	551.7
1964	162	281	578.3
1965	174	308	---

* Research Department, Bank of Korea. Economic Statistics Yearbook, 1965, p. 154.

** Drawn from data published in Soybean Blue Book, 1967, American Soybean Association.

Appendix A

Experimental Program

I. Agricultural Aspects

A. Production of Soybeans on a Factory Associated Farm.

A small farm for introducing production of soybeans is a desirable adjunct to the industrial food processing program. Its operations would provide a basis for later commercial farming of the commodity. Approximately 10 hectares would suffice for the pre-commercial phase. It would furnish about 10% of the pre-commercial requirements of raw material. Training of farm personnel, tentative selection of crop varieties, and establishment of preliminary patterns of irrigation, fertilizing, and insect and plant disease control could be carried out on a small scale before initiating later full-scale operations.

B. Cost of Pre-Commercial Experimental Farm.

Farm land is estimated at $200 per hectare. Accordingly the farm land would come to $2,000. Some farm sheds, implements, seed, and fertilizers and other small working cash provisions would be needed which would add about $2,500. Labor required would be about 4 men, one of whom would be a supervisor. Three would be paid about $1.50 per day and the supervisor would get $2.00 per day for a per annum cost for labor of $2,340. Total costs of experimental farm would be $6,840.

II. Food Technology Aspects

A. Formulations with Various Local Products.

An attempt would be made to develop alternative formulations of the beverage and other forms such as noodles, gruel, soups, etc., using soy in combination with materials from local products such as corn, chick peas, lentils, safflower and especially fish meal. These would be formulated in various combinations using materials readily available in Korea to develop an optimum amino acid pattern from low-cost indigenous resources. Most of these products will be formulated at the Meals for Millions experimental plant and laboratory facility in the U. S.

B. Testing of Formulations.

While products can be developed in the laboratory and be consistent with taste preferences here, they must be tested *in situ* to determine acceptance at the point of consumption. Several of these formulations, particularly the basic beverage, will be tested during the acceptability trials and the cost of doing it is covered under Phase II above. Additional testing of other formulations would add another cost factor. Such products would increase the "marketable line" for commercial development.

C. Costs of Additional Test Processing.

While the developing of new formulations will be carried out at the Meals for Millions experimental plant and laboratory in the United States, and their direct cost can be absorbed, additional indirect costs for field testing and evaluating these in Korea would be incurred. These are estimated to be about $2,000.